

SAFETY AWARENESS, PILOT EDUCATION, AND INCIDENT
REPORTING PROGRAMS

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MR. ENDERS: The decade of the 1980's may well become known as the decade of destabilization in air transportation. I'm going to give you a little background on a broad view of safety which is far beyond the regional picture, but I thought it might help to set some sort of a perspective for remarks that I'll get into a little bit later about safety awareness and pilot education. The economic upheaval domestically and overseas has created all manner of pressures on aviation operations that can and do have erosive effects on the remarkable margin of safety that we've so painfully constructed over the past two decades. The record is a record to be proud of. Internationally last year, the ICAO scheduled airlines carried over 740 million passengers in operations totaling over one billion passenger miles. 740 million passengers is about two and a half times the total population of the U.S. or three-quarters of the population of Mainland China. So, they moved a lot of people. There were 23 fatal accidents accounting for 732 lives lost. Now, 732 lives lost, as regretful as that loss is, out of 740 million seems to me like a pretty darn good risk.

During our annual International Air Safety Seminars the Flight Safety Foundation has been privileged in recent years to have Mack Eastburn, Senior Safety Officer of American Airlines, present the leadoff paper, "How safe are we?" It is a yearly report on the running average of safety achievements throughout the world. Mack uses an unconventional measure of safety: Jet hull losses per jet flying hour. While there are many airlines flying today that are using propeller equipment, I feel that Mack's criteria probably provides a useful measure of safety achievement.

Can I have the first slide please? This slide shows the overall cumulative safety record in terms of jet operations. You can see that the U.S. has accumulated about two-thirds the total flying time of the world in general, and it accounts for about half of the hull losses, so the U.S. operations are ahead of the rest of the world, safety-wise.

The second slide shows a comparison of the hull loss rates in terms of hull losses per jet flying hour. One can

see that the United States loses one jet hull, which may or may not be a fatal accident, but representing a severe accident, in about every 860,000 jet flight hrs. Australia and the South Pacific region come in as champions with one hull loss in about one million nine hundred thousand hours. These, incidentally, are not regions of registry of the aircraft, these are regions where the accidents occur, so they reflect not necessarily how well an airline is running -- is run, but primarily the environment in which the aircraft is operating. Europe comes in pretty close to the U.S., but Asia and Africa and Central and South America are down at the low end of the totem pole. This gives you a perspective on the U.S. record in relation to the rest of the world.

This next slide is just a trend graph, on a slightly different scale, and you may have seen it before, comparing the U.S. hull loss rate with the rest of the world. You can see the U.S. comes in pretty well by comparison.

Comparing the hull loss with the fatal accident rate in this next slide shows that they track pretty well together.

This next slide shows another method of looking at air safety in the U.S. It was put together by Nick Engler of the University of Dayton Research Institute. It shows the fatalities per million passengers carried. Going back into the early phases of air transportation, you can see that the rates were pretty high. The risks were high back in the 20's and 30's, and they've fallen pretty dramatically. This is plotted on a logarithmic scale, so the falloff is quite substantial. The rates are down pretty much now in the realm of wondering if we can do any more to improve the accident rate by looking at the improvement of the aircraft or the system.

This next slide is just an impact chart that shows that accidents, in addition to costing lives, cost a lot of money. Someone has to pay it, but if we don't have to pay it, we'll have plenty to develop air transportation. So that's an economic plug for safety and gets away from just maybe the altruistic and very moral view of saving lives.

This next slide is another presentation that you may have seen before of the distribution of hull loss accidents by phases of the flight. Of significance here are the numbers at the bottom that show the percentage of time of exposure to the different phases of flight. The figures at the top show the actual percentage of accidents occurring in each phase of flight. So, for example, in 12 percent of the time spent in takeoff, initial and climb phases, initial climb and climb out, thirty-eight and a half percent of all accidents occur in that regime, and of course, in the

landing areas, as you would expect, 53 percent of the accidents occur with a 14 percent exposure time.

This slide presents factors in fatal accidents that have been determined by the appropriate authorities. It does set the priorities where work really needs to be done. You can see that the crew human factors area needs some attention.

The reason that the U.S. comes in pretty well on this comparison bears witness to a unique situation that we have here in this country. The U.S. manufacturers account for about 80 percent of the world's airline fleets. The FAA, manufacturers, and airlines have an integrated relationship in this country, unlike other areas of the world, that provides a most efficient and standardized feedback, imperfect as it may be. The U.S. and Europe also have the advantage of a larger pool of skilled and educated workers to draw from for the aviation effort. Yet, only two decades ago, our record was not one to be proud of. We have learned from experience. Not only was the FAA a powerful force for compliance with good operating practices, the pilots' organizations spent a great amount of effort in educating their members and fostering safety awareness. The airlines gradually established safety officers or departments to give emphasis to the need for attention to operating in a safe manner. Airline engineering departments served the safety function admirably through their quest for efficiency and reliability. There were a lot of things going for safety improvement in the United States.

We have come a long way in establishing this record of safe travel and dependability in the minds of the majority of passengers. The level of operational safety far exceeds that required as a minimum acceptable level of safety by the regulations. We call this exceedance of the margin of safety. It cannot be measured in quantitative terms, but it is comprised of many, many factors. For example, the mechanical part of the system has evolved to a very high degree of reliability. The communications network, though we can all find fault with it, permits far more information to be passed than ever before. Navigation equipment and weather radar provide means of precise reckoning and avoidance of severe weather. Maintenance methods have also improved with new ways of insuring that the machine and its equipment will perform properly. And training methods, as we talked about yesterday, have, of course, improved drastically, as has our understanding of the human operator and the ways in which he makes decisions and performs tasks.

Technology is the handmaiden of aviation progress. Always responding to economic factors, technology has provided the performance gains that traditionally kept the

airline one step ahead of the bankers. The economic pressures now being felt have generated a flood of technical innovations that are appearing in cockpits, structures, engines and accessory equipment. Coincidentally, these pressures are changing the procedures that we have traditionally become used to. Route structures are changed, new freedom of entry and exit to the markets is testing the conventions of aviation. In short, we are operating in a destabilized environment.

The history of air transportation development is replete with examples of moves to standardize certain functions. For the most part, this standardization was rationally undertaken as a result of the findings of many accident investigations that clearly indicated an inability of the designer to anticipate certain actions of the crew or performance of the airplane under unexpected operational conditions, and an inability of the crew to control many variables at once during critical phases of the operation. Thus, we have the standardized three-degree glide slope, checklists, maintenance procedures, standardized training requirements, standardized medical checks, crew rest regulations, standardized weather observation formats and so on, all effective in cutting down the amount of uncertainty of when the pilot has to make a decision either in flight planning or in operation. Gradually, the supporting infrastructure of the aviation business grew to insure that the pilot could make his decisions with a reasonable amount of confidence. This has resulted in a stabilization that has established a very comfortable margin of safety. It translates into a system that is very forgiving of error.

However, it's worth noting that while the human intellect has created this marvelous system, the human in the cockpit that has to contend with all these improvements, often making snap decisions that can determine the difference between safety and tragedy, is still the old Mark I Human Being that went aloft in balloons in the 1700's, attempted heavier-than-air flight in the 1800's, and triumphed at Kitty Hawk in 1903. There has been no comparable improvement in old Mark I Human Being as regards skeletal or muscular strength, speed of reaction, improved vision and hearing, mental capacity or any other human attribute.

We don't even have a Mark I, Mod I or Mod II!

So this presents us with the dilemma of how to use this new technology to its best advantage and still maintain control over it. We have to determine how to bridge the gap between the capabilities of man and machine.

Added to the technological challenges just mentioned

are the changes in the operational picture. Deregulation has spawned an entirely new operational game. Smaller airlines have organized and have entered the market with lean organizational staffing. And yesterday we heard very clearly how well they are coping with this situation. They've done very well safety-wise, so far. The larger, older airlines have been forced to trim staffing. To date we have seen medical staffs, meteorology staffs, engineering staffs and safety staffs cut back or eliminated. In a stabilized environment, these impacts might be accommodated with little effect. However, I wonder how well the managements of the large airlines and the new entry small airlines are coping with introduction of this flood of new technology and the other changes in the system. The answer must lie in how the safety function is preserved within this new situation. Human beings are remarkably adaptive organisms, and if the motivation is right, they can function in a variety of effective ways. The bottom line is that the organization must provide for effective means of selecting, training, motivating, supervising and supporting its flight and maintenance crews to ensure that they have the best grounding in knowledge and experience available.

SAFETY AWARENESS

The term "Safety" defies precise definition. Jerry Lederer, in his Wings Club address last year on safety perspectives, noted that safety is a relative term that must be interpreted in the context of what is acceptable to the public. Some people would rather speak of risk management than safety. There is a subtle difference here. The term risk management confronts reality and recognizes the inevitability of risk. Safety, on the other hand, implies an ideal that must be sought, though never absolutely reached. Perhaps it is a matter of attitude. Maybe we'd try harder if we seek safety than if we merely manage risk.

But risk management is a good concept. The idea of managing risk appeals to the ego because it implies control. Safety is more of an abstract concept. Risk management lends itself nicely to processes that can be measured, such as insuring reliability in hardware performance. If one can define a failure rate of a component by keeping performance records of a large number of components, one has a quantitative handle on the risk of failure. When we get away from hardware, however, and talk of human error or failure in the context of risk management, we have quite a different situation. We are no longer in a quantitative field; we are very definitely in a qualitative or subjective mode.

What then of risk? Risk comes about because of ignorance, coupled with a perceived need to act. At the very simplest, for example, if we get into a cockpit of an

airplane that we haven't been checked out in, and proceed to fly the boss and his staff to a distant airport without checking the weather because the boss said that he had to get home right now, there's no one in this room that would dispute that this operation is potentially at great risk. On the other hand, if we are thoroughly checked out in the airplane, have practiced extreme emergency procedures in the simulator, have a lot of time in type, have a strong background in understanding weather and experience in flying in bad weather, and maintain a professional awareness of safety factors, and have a boss that defers to his flight crew's judgment about the likelihood of safely completing the flight, I think you would all agree that the risk has been substantially reduced. To the extent that the several factors mentioned in this example can be managed, we have managed the risk.

Man is a risk taking animal. He will always chafe at boundaries, probing, testing and finally venturing beyond to see what awaits. If it weren't so, we would have ceased to exist as a species long ago. Sometimes he's successful; sometimes he's surprised; and sometimes he dies.

Since it is inconceivable for man to remain inactive, he must act. We must, therefore, reduce our ignorance in order to reduce risk, or preferable, to closely approach that idea of safety. We do this through learning as much about our machines as we can, by learning as much about the environment in which we will be flying, by learning as much about our organization to make sure that we understand its inevitable weaknesses, where they are, what department one can depend on strongly, or when it is better to take a little extra action on our part, and by learning as much as we can (or dare) about ourselves. We must keep our minds and bodies in as operable a shape as possible against that ultimate challenge that a "Murphy" or electronic glitch or Mother Nature will eventually throw at us, usually at the least expected time.

We must maintain an awareness of all the factors that affect safety of flight and ensure that they are under control, either through the design or through our skillful operation.

Pilot education sometimes has been described as a horse watering problem. I will attend a meeting of the Orient Airlines Association in Manila next week that has the theme: "Changing Attitudes in the Face of Progress." The papers that are to be presented deal with the interface between the human and the system. Since the system is designed by humans with all of the potential for error that that implies, we are faced with the problem of educating a pilot to deal successfully with a system that may or may not work the way it is intended to work. There are many management textbooks written about decision making under uncertainty. This is certainly a good description of the pilot's problems.

The pilot starts out with his initial training, followed by some period of logging time and gaining experience. If he's wise, recurrent training will follow either in flight or simulator; preferably both, and study. I hear from a lot of old heads these days that the younger generation coming into the flying game is not hitting the books like they should off duty. I don't know whether that's true or not. I hope that it indeed is not true. There's no way that a pilot can learn everything needed to keep out of trouble without spending a lot of time burning the midnight oil, learning everything he can about the aircraft types he's flying, about weather, procedures,

emergency procedures, aerodynamics, operations in foul weather and so on. The profession of flying demands an absorbing mind. The professional pilot will prepare himself for the eventual transition into new equipment without waiting for the formal company training program. He'll maintain an awareness of what's coming down the road and be ready for it.

Jerry Lederer is fond of quoting Ralph Waldo Emerson's phase: "Learn from the mistakes of others, you'll never live long enough to make them all yourself." And that was more or less the basis for the founding of the Flight Safety Foundation. And we follow that theme today. The individual airline pilot has a difficult time finding out about safety information outside of the institutional issuances of FAA bulletins or the manufacturer's directives. The Foundation publishes quite a number of bulletins, as shown in this montage I also have here with me a sample binder full of a year's bulletins that you're welcome to peruse and look at, at your leisure. I wish that I could have brought enough to send home with everybody, but that was a physical impossibility.

We find a wide variance among our 400 member organizations in how they make safety information available to their employees. In general, there's a good correlation between airlines and corporate flight departments that have excellent safety records and those that have some identifiable safety function, whether it's an actual safety department staffed with several people, or an individual that is designated as safety officer, or the function is preserved within the normal operational organization. The more enlightened airlines establish this function to be the organization's safety ombudsman with full support of the management. And when I say full support of management, I mean just that; that management does not interfere or become nosy about who's doing what, but that they want to make certain that there is, as it were, a neutral third party or ombudsman within the company to whom the crews and the maintenance people can confide if they've got safety problems. We've heard variants on this yesterday in some of the descriptions of how the regional airlines were coping with the problems.

The safety function collects and disseminates safety information from within and without the company to operations, maintenance and management. In full mutually supportive partnership with management and the operating crews and maintenance staff, this can be an extremely effective function in keeping the airline out of trouble. One of the many pilot organization members of the foundation has contracted with us to furnish every member of their organization with a personal copy of our monthly Accident

Prevention Bulletin. That came about because in some companies, who were full members of the foundation, our bulletins never got beyond the operations director's desk, so the pilots' union took it upon themselves to spread the word to all of their operating crews. Now, on the other hand, many airlines distribute our full range of publications to their pilot domicile offices where they are available for perusal in the pilots' lounge or on the bulletin boards. Nearly all of our airline members reprint or extract from our publications in their internal publications on safety and operations.

This last slide that I have here is a representation of another safety function that the foundation provides in terms of workshops and seminars. We have every Autumn an international air safety seminar directed to air carrier flight, primarily, but not exclusively, international and big iron. It's held at various locations around the world: Rio this Autumn; we were in Johannesburg last year, in Christchurch, New Zealand and in Acapulco before. Next year we'll be in Zurich, and then in 1985, we'll be in Boston, and in Vancouver in 1986. I hope that many of the regional airlines here will take advantage of attending and having a chance to meet colleagues in the business from overseas and to exchange ideas and thoughts about safety.

These seminars and workshops are unique because the Foundation is an independent, nonprofit organization. We have no ties to any government or single aviation faction. We provide these objective forums where safety issues of a sensitive nature can be discussed without rancor or incrimination, and they've worked pretty darn well over the years.

The point of the foregoing is not that the Foundation is the only source of safety material. There are many excellent publications that feature useful and practical articles on safety and safety related topics. Mentioned yesterday were good articles in Business Commercial Aviation, for one; Flight International, Aviation Week, and the fledgling International Journal of Aviation Safety are others.

The FAA publishes a host of material on safety from the Airmen's Information Manual, to Advisory Circulars, to research reports, covering a variety of topics concerning the airplane, the system, weather, human factors, and air traffic control. The NTSB's accident reports and their green sheets convey vital information about the probable causes of accidents.

Are they available to the pilots? How many of you here regularly see these sorts of things? Do you get this

filtered down to you? Not much -- not much transmission of information. Of special significance are the excellent publications coming out of the NASA Aviation Safety Reporting System Office. CALLBACK and the quarterly reports contain information about human error that is simply unavailable anywhere else. NASA has done a great public service in making CALLBACK available to individuals who express an interest in receiving it. The special reports are undoubtedly less widespread. Company safety officers in what I call the enlightened airlines avail themselves of all of this, they make copies available for direct perusal by their staff or they publish excerpts or the meat of these faults and articles in their company bulletins. But, then, we come back to that old horse watering problem. How many pilots take the time to read it and educate themselves? And the manufacturers publish good stuff, too. Coming to mind is Douglas' DC approach, and the Boeing Airliner, and so on. They contain excellent information about safe operating practices. They're generally available for the asking. But, again, I suspect that most of you are unaware of the existence of a lot of this or that you can even get them on an individual basis.

Well, the Foundation was founded on the principle of sharing safety experiences among its members. To that end, we regularly receive the in-house publications of most of our operational members worldwide. It gives us a very unique perspective on safety matters. Our publications reflect this perspective in topics as diverse as human judgment training, mental incapacitation, wind shear warning, and so on, and you'll see these and other topics referred to in the sample bulletins here. There's a wealth of safety information available. What is done with it is another matter. That depends on the individuals' or companies' attitudes toward safety. I suspect that an organization that has had a fatal accident in its experience has a much different attitude about safety information than one that has not been through such a tragedy.

One of our airline members has established a safety department headed by an active line captain, assisted by a full-time returned military pilot, and augmented part-time by two flight crew and two cabin crew staff members. This safety department reads every flight record and consults privately, without recrimination, with crews of flights where irregularities are found. This safety department has established a rapport with the crews that encourages pilots and flight attendants to come to them with concerns about particular flights or situations that need correction. I would suspect that the margin of safety in that airline's operation is substantial.

At the other end of the spectrum is an overseas

conference attended by the Flight Safety Foundation several years ago when the Aviation Safety Reporting System was just beginning in this country. When our delegate recommended the establishment of an anonymous reporting system like ASRS in their region, one of the flight operations directors attending spoke up that in his airline, if a pilot committed an error, he was expected to tell him about it; then he would determine his punishment. How foolish we are if we don't listen to what's going on in our own organization and take action to improve the situation.

Well, to sum up, then, risk occurs because of ignorance and the perceived need to act. We must carry on the operation, so the perceived need to act is there. We have to act. If we act with knowledge, the risk is reduced. It behooves every pilot and his company to avail themselves of every bit of safety and operational information possible and to employ it in a professional manner to ensure that the flight will be routine. The Foundation and these other organizations I mentioned are here to help you to find the kind of information that you need, and if we can help out in any way, don't hesitate to call us. Thank you.

DISCUSSION

DR. LAUBER: Thank you, Jack. Why don't we, before we put Bill Reynard on, take any questions for Jack Enders. Do we have any out here? Ed Carroll has one.

CAPT. CARROLL: Jack, maybe there's something to be learned from the Australian, South Pacific experience. The numbers seem to indicate that they have better than two times the exposure or safety record that we have. And also, I guess an associated question as to what we might learn from them, in that regard, is their ratio of cockpit crew problems parallel to ours, or is there a sharp distinction there as well?

MR. ENDERS: There have been a lot of people looking into why that region of the world has substantial margin over the rest. There are several factors, I suspect, that are at work here. One is that the Australians have had for many years a mandatory reporting system. By law, pilots are required to report incidents. I've talked with pilots over there who are of the opinion that if they didn't already have it, it would be impossible to establish such a mandatory system in today's social and economic environment, but they have it, and they're holding on to it. And so I think that system coupled with lower density operations, and while they certainly have fog and low visibility weather, they don't have the extreme climatic changes that much of

the rest of the world has, are positive factors in their record. And the other very real factor is that since they're so far from anywhere, aircraft log a lot of time enroute, so if you look at that other graph, that shows 53 percent of the accidents occur in the approach phase, it adds a lot of "nonevent" time. I think all of these factors account for their good record.

CAPT. CARROLL: How about the crew involvement?

MR. ENDERS: I don't have enough information about that to offer an opinion, Ed.

DR. LAUBER: Other questions for Jack?

Thank you, Jack. A matter of curiosity, how many airlines represented here, have a recognizable safety department or an individual in charge of safety? Can we have a show of hands on that. How many publish a safety bulletin or otherwise disseminate safety information? Okay. I was curious as to exactly what the situation was.

With that, I'll turn the podium over to Bill Reynard for discussion of the Aviation Safety Reporting System, which is another approach to pilot safety and education, and, again, offers a rich source of material that you people could use in putting together safety awareness programs. Bill?